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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/777,026	02/11/2004	Mark N. Kawaguchi	8033/ETCH	2197

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EXAMINER

TRAN, BINH X

ART UNIT PAPER NUMBER

1765

DATE MAILED: 10/31/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/777,026

Applicant(s)

KAWAGUCHI ET AL.

Examiner

Binh X. Tran

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 11 August 2006.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-23 and 25-32 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-23, 25-32 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 112

1. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

2. Claim 14 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In line 1-2 of claim 14, "a forming gas" (emphasis added) is indefinite. It is unclear from the claim whether applicants wish to refer to the previous forming gas (in claim 9) or not. The examiner suggests replacing "a" with --the--.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to

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consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

5. Claims 1-23, 26-32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chen et al. (US 5,545,289) in view of Belyansky et al. (US 6,562,713).

Respect to claims 1-2, 21 Chen discloses a method for removing halogen-containing residue from a substrate, (col. 5 lines 1-6), the method comprising the steps of:

providing an etched substrate having a halogen-containing residues, comprising at least chlorine (col. 5 lines 1-6; col. 6 lines 40-50)

heating the etched substrate to the temperature about 150°C to 400 °C (read on applicant's range of "at least 50 °C" and/or "50 °C to about 450 °C [claim 2]; See col. 8 lines 50-60);

exposing the heated substrate to a plasma that removes the halogen-containing residues, col. 6 lines 40-50; col. 8 lines 60-67, col. 13-14, Table I).

Chen fails to disclose the halogen-containing residue is formed during etching of a polysilicon layer on the substrate. However, Chen clearly discloses the halogen-containing residue (24) is formed during the etching step of layers on the substrate. Chen further discloses layer (28c) comprises silicon material (col. 4 lines 62-65). In a semiconductor process, Belyansky teaches to etch polysilicon layer to form a polysilicon gate using halogen gas (col. 3). Belyansky further discloses the halogen-containing residue (bromine residue) remains after the etching of polysilicon layer can be easily removed using oxygen plasma (col. 4 lines 1-12). It would have been obvious to one

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having ordinary skill in the art, at the time of invention, to modify Chen in view of Belyansky by etching a polysilicon layer using halogen-containing gas including bromine because the bromine residue can be easily removed after the etching step. Further, polysilicon layer is needed to form a polysilicon gate.

Respect to claims 3 and 23, Chen discloses forming the plasma by energizing a gas mixture in a remote plasma reactor (54) (See Fig 2). Respect to claims 4 and 26, Belyansky discloses the halogen-containing residue comprises bromine (col. 4 lines 3-12). Respect to claims 5 and 27, both Chen and Belyansky discloses the plasma comprises an oxygen-containing gas (Chen's Table 1; Belyansky's col. 4 lines 10-12). Respect to claims 6 and 28, Chen teaches to use oxygen plasma and an additive comprises N₂ (Table I).

Respect to claims 7 and 29, Chen discloses the halogen-containing residue comprises chlorine (col. 5 lines 1-5). Respect to claims 8-9 and 30-31, Chen discloses the plasma comprises water vapor (i.e. hydrogen-containing gas), oxygen and nitrogen (See Table I in col. 13 and 14). Respect to claims 10 and 32, Chen discloses the heating step comprises heating the substrate in a gas mixture of oxygen and nitrogen (Table I). Respect to claim 11, Chen discloses the temperature of about 250 °C (Table I, example 2-6). Respect to claim 12, Chen teaches to use 3000 sccm of oxygen and 300 sccm of nitrogen (col. 13 lines 38-42). The flow ratio of oxygen to nitrogen equals to 3000:300 = 10:1.

Claim 13 further differs from Chen by the specific flow ratio of oxygen to hydrogen and hydrogen to water vapor. However, Chen clearly teaches to change the

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flow rate of individual gas and flow rate ratio are result effective variables (col. 7 lines 25-31, col. 8 lines 25-35, Table I, col. 13 lines 40-42, Table IV). The result effective variable is commonly determined by routine experiment. The process of conducting routine experiments so as to produce an expected result is obvious to one of ordinary skill in the art. Hence, it would have been obvious to one having ordinary skill in the art, at the time of invention, to perform routine experiment in order to obtain optimal flow rate ratio as an expected result.

Respect to claim 14, Chen discloses the passivating gas comprises 3000 sccm O₂ and 300 sccm NH₃ (read on applicant's forming gas). Respect to claims 15-16, Chen discloses the flow rate of water vapor is about 300 sccm (Table I, read on applicant's range of 100-3000 sccm) and the flow rate of oxygen is about 3000 sccm. The flow ratio of oxygen to water vapor equals to $3000 \text{ sccm} / 300 \text{ sccm} = 10:1$.

Respect to claims 17-18, Chen discloses the pressure of about 1-10 torr, preferably about 2 Torr (col. 6 lines 52-63) and the duration for the exposing step is about 40-60 seconds (table 1, example 1-2, 8).

Respect to claims 19-20, Chen discloses the pressure of about 1-10 torr, preferably about 2 Torr (col. 6 lines 52-63) and the duration for the exposing step is about 40-60 seconds (table I, example 1-2, 8).

Respect to claim 22, Chen discloses the temperature is between 200-250 °C (Table 1, read on applicant's range of 150-400 °C).

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6. Claim 25 is rejected under 35 U.S.C. 103(a) as being unpatentable over Chen and Belyansky et al. as applied to claim 21 above, and further in view of Wu (US 6,133,102).

Respect to claim 25, Chen fails to disclose the etching the substrate having a film stack with a gas mixture comprising a halogen gas and a reducing gas. However, Chen and teaches to etch using halogen gas (BCl_3 and Cl_2). Belyansky clearly teaches to etch to etch polysilicon layer using halogen including Cl_2 , Br_2 , F_2 (See col. 3 lines 49-65) or HBr/O_2 (col. 4 lines 5-10). Wu teaches to polysilicon layer (120) by using halogen-containing gas (CF_4) in addition with hydrogen gas (read on reducing gas) or HBr/O_2 (col. 3 lines 41-51). It would have been obvious to one having ordinary skill in the art, at the time of invention, to modify Chen and Belyansky in view of Wu by using halogen gas and reducing gas (i.e. H_2) because equivalent and substitution of one for the other would produce an expected result.

Response to Arguments

7. Applicant's arguments with respect to the previous 35 USC 102 (b) or 102(e) rejection have been considered and are persuasive. Therefore, the previous grounds of rejections have been withdrawn. However, upon further consideration, a new ground(s) of rejection is made as discussed above.

Conclusion

8. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP

§ 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Binh X. Tran whose telephone number is (571) 272-1469. The examiner can normally be reached on Monday-Thursday and every other Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on (571) 272-1465. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should

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you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Binh X. Tran

DUY-VU N. DEO
PRIMARY EXAMINER

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10/26/06